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SUBJECT: Methodology for Determining Priorities for Road and Bridge Betterment in Aceh Province, Indonesia

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During the Asia Advisory Committee Meeting for Capital Assistance held on March 20, interest was raised concerning the methodology which would determine priorities for improvement of road segments for the national and provincial highway system in Aceh Province and would identify the level of improvement most feasible for these road segments. Attached is a detailed description of this methodology as promised at the meeting.

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Ministry of Public Works & Power
Directorate-General of Highways
(BINA MARGA)

First Technical Report

AN APPROACH TO HIGHWAY PLANNING

BY

Dr. V.G.Bhatia

Highway Planning Coordination Project
(INS/72/019)

JAKARTA
June 197

This report has not been cleared with the office of Technical Cooperation of the United Nations, which does not therefore necessarily share the views expressed.

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AN APPROACH TO HIGHWAY PLANNING

FOREWORD

This is by way of a report on my Phase I activities for the period 16 April 1973 to 31 May 1973 and my suggestions for work for Phase II.

ABSTRACT & SUMMARY

In this report, an attempt has been made to present an approach to the preparation of a rational highway investment program so as to provide a rational answer to the question of which road links of the existing highway network should be improved and to what extent, given a budgetory ceiling constraint. Also to answer the question as to how much money is required to develop the highway system to an optimal level - consistent with the requirement of the projected traffic and costs and benefits to the economy. The data required, who should provide which data, and the further studies required to be undertaken have also been indicated. It has been recommended that we begin to collect the data and undertake the studies indicated without delay.

Also that the present Bina Marga organization should be strengthened to undertake this task.

...

INTRODUCTION

THE SETTING

Transport plays an important role in the development and functioning of the economy. This is widely accepted. What is not always realised is that the relationship between Transport and the rest of the economy is of two kinds :

a) Servicing role of transport and

b) developmental role of transport

both are of course inter-related.

By former we mean that transport service must be provided in adequate measure, when it is needed, where it is needed - otherwise the rest of the economy will be handicapped and may in fact grind to a halt if the transport bottleneck persists. As the economy develops and the process of the production becomes more interdependent - both locationally and sectorally, the role of transport becomes more and more critical. By developmental role of transport we mean that we explicitly recognize the role that transport can and should be allowed to play as a catalyst for the development of the rest of the economy.

A sound transport policy must therefore explicitly recognize the two fold role of transport and must aim at development of all modes of transport in such way as not only to ensure that the total transport needs of the economy are met at minimum cost to the community but also that the investment in transport makes a maximum contribution to the development process and earns the highest economic return possible.

...

Since Highways and Highway transport are only one out of many modes of transport, one cannot, and should not, look at Highways and Highway transport in isolation. A coordinated development of all modes of transport, exploiting the inherent advantages of each mode of transport for the total good of the economy is a must. Similarly Highways also can not be considered in isolation as distinct from Highway transport. And, it goes without saying that transport development for its own sake has little meaning; the relationship between transport and rest of the economy must be explicitly considered.

It is therefore obvious that for a rational development of Highways it is necessary also to study, in depth, Highway transport industry, the relevant other modes of transport, as also other sectors of the economy served by the highways - agriculture, industry, mining etc., particularly in the hinterland of the road link.

The task is, therefore, not easy. The determination of costs of improving highways to different levels/construction options and maintenance, and the study of choice of materials and the technology of construction/maintenance with a view to locate the appropriate technology for a labour-surplus economy is itself a major task but it is a small part of the total task.

DETERMINATION OF AN OPTIMAL LEVEL OF DEVELOPMENT OF THE HIGHWAY SYSTEM UNDER A GIVEN BUDGETORY CEILING

As already indicated, the preparation of a Highway plan must be done in a broader framework. Yet, our effort must be to develop

a methodology for providing a rational answer to the question o which road link should be developed to which extent at this tim (say, during Repelita II) - a methodology which is simple and operationally meaningful, yet does not lose sight of the larger setting.

Presented below are the outlines of a model which attempts to d precisely that.

Road Links

Let the total Highway System be divided into N number of road links, L_1, L_2, ... L_N. (Li, i = 1 to N).

Thus, for example, Road Link from Jakarta to Bogor is called L_1, from Bogor to Bandung L_2, Bandung to Jogjakarta L_3, etc., till w have listed all the roads in Indonesia. The level of aggregatio at which we want to work, i.e. whether we should consider the road link from Jakarta to Bandung as one link and call it L_1 or should we divide it into 3 or more links, is a matter of judgemen The model is general enough to take care of any level of aggrega tion we want to work with, whether N is very large or smaller. The point to be remembered is that the road links should be so chosen as to permit us to calculate the costs, benefits etc. we need to, reasonably accurately.

Construction options

For each road link, we have a number of construction options. For example :

Option 1 : Do nothing

Option 2 : Normal maintenance

Option 3 : Heavy support maintenance and rehabilitation.

Option 4 : Improved drainage, strengthened base, and normalising of dangerous curves.

Option 5 : As for 4 but with improved, widened and strengthened shoulders capable of allowing the vehicles to go off from the paved surface to shoulders for overtaking, or passing vehicles coming from opposite direction without having to stop.

Option 6 : As for 5, with minimum 6 meter pavement,

and so on.

Money Costs

Corresponding to each "Construction option", for each road link, there is a Cost; thus for the do-nothing option the Cost is NIL. Let the money Cost of upgrading road link i to Construction option j be Mij.

Thus Mij is the money cost of upgrading the road link i from its present condition to the level j (construction option No.j).

When i = 10 say, (i.e. there are only 10 road links in the whole country) and j = 6 (only 6 construction options are considered), then the costing Engineers have to provide data for 6 options for each of the 10 road links.

This requires that the Costing Engineer must know the present condition of the road link fairly well and must be able to estimate reasonably accurately the cost of upgrading it to various

levels of "Construction Options".

The money cost is, in fact, not one figure but a series of figur of expenditure over a number of years, both for construction and maintenance.

This series can be reduced to one figure by taking the sum of present values if the rate of discount to be used is known.

The money cost estimate may be indicated in two parts - the Rupi Component and the foreign Exchange (say, US Dollar) component.

It may not be possible to indicate this without deciding on the choice of technology question, to which we will come presently.

Economic Cost

Corresponding to each figure of "Money Cost", there is "Economic Cost", which is defined as real cost to the economy. Thus, for example, in a labour-surplus economy the money cost of labour used (i.e. wages paid) do not truely reflect the real cos to the economy, if the labour so employed is otherwise unemploye or underemployed (Real cost of labour is zero or near zero, if labour used would otherwise be unemployed. Please see Appendix for treatment of labour component. Incidentally, we have to calculate the direct and indirect labour component, i.e. labour component of materials - as labour used in quarrying/breaking stone, of transporting material etc. have also to be explicitly calculated).

Similarly, in an economy where foreign exchange is scarce or a major constraint and the official exchange rate does not truely

reflect the scarcity or real value of foreign exchange, then an adjustment is needed also for the foreign exchange component of the money cost of upgrading (each construction option); by using shadow rate of exchange rather than official rate of exchange. (Here also direct and indirect foreign exchange required for each construction option has to be calculated).

How to determine the real cost of foreign exchange or the true ("shadow") rate of exchange is a separate excercise which can be attempted, but is perhaps best left to "experts" in departments dealing with the subject. Suffice is to say that it would involve a study of present and expected future balance of payments, aid, debt servicing burdens, export potential, import demand elasticities etc. The real cost of foreign exchange is the real cost of the last item of export (at the margin) to earn one unit of foreign exchange (say, US Dollar) so that the foreign exchange account is balanced. One can use a programming model to determine the shadow rate of foreign exchange or a "trial and error" method may also do as a first approximation.

Similarly, in a capital-scarce economy, where the interest rates do not adequately reflect the real cost of capital to the economy, an adjustment on this account is also required, to arrive at "Economic Cost" corresponding to figures of "money cost". Here also direct and indirect capital component has to be calculated first.

Other adjustments required for converting "Money Cost" figures into "Economic Cost" include adjustment for tax components, both direct and indirect, since tax is not real cost but a transfer (it

may even be considered a benefit since transfers to national exchequer is a plus point if the public funds are used wisely fo the overall good of the country).

Choice of Technology

For each "Construction options" for a particular road link we spoke as if there is only one set of "money cost" figures (and, course, the corresponding "Economic Cost" figures). This assumes that there is no technological choice available for the Engineer, there is only one way of upgrading the road link from its present level to that particular "Construction option", which involves a fixed amount of money cost (over a period of years in a fixed manner) and involves a fixed proportion of different components - labour component, foreign exchange component, etc. In reality, fortunately, we have technological alternatives - from a highly capital, and foreign exchange, intensive technology e.g.when the work is contracted out to a foreign contractor from Europe or USA etc., to a highly labour-intensive technology where the labour component is as high as 80% or more. There is also a temporal choice available-we spend a large sum of money and build a beautiful concrete road (with high capital and foreign exchange cost) in a short period which will practically require no maintenance for say, 20 years, as against building a road with labour-intensive technology which requires regular maintenance (which is also labour-intensive) year after year.

The costing Engineer has to work out alternative costs corresponding to different levels of technology, and choose that technology which is appropriate or optimal for the conditions prevailing in

the country. A simple way might be to work out the minimum "economic costs" for each construction option for a particular road link - though a more desirable course would be to use a better optimising criterion for chosing the "best" or "most appropriate" technology, e.g. a criterion which explicitly takes into account not only the real costs but also benefits to the economy, corresponding to each technological alternative.
Thus regular maintenance, if required, means regular jobs which is an important plus point in a labour-surplus economy, since not only the real cost of regular maintenance is low but jobs have a value of their own. On the other hand regular maintenance may mean slowing down of the traffic which also has a real cost to the country.
Therefore the true costs and benefits to the economy as a whole have to be calculated in order arrive at "best" or "appropriate" technology and corresponding money and economic cost for each construction option for each road link.

It will thus be seen that even before the Engineer provides us the cost figures for each construction option for a road-link, an optimisation has been done with regard to the choice of technology and the cost figures we use hereafter, both the "Money Costs" and "Economic Costs" are the ones for the "best" or "appropriate" technology.

Economic Benefits

Corresponding to each construction option for a road link there is a Benefit to the economy resulting from the upgrading of the road link from its present condition to the level of that construction

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option.

Let Bij be the benefit that accrues to the economy as a result upgrading of road link No.i, from its present condition to the level of construction option j.

In reality, of course, Bij is not one figure but a stream of benefits spread over a number of years, Bijt (t = 1, 2 .....) This stream of benefits could be converted into one figure by taking the sum of discounted present value of benefits, if the rate of discount to be used is exogeneously given.

Benefits resulting from an improvement of a road-link may accru in the form of any or all of the following categories :

(1) Reduction in road maintenance cost
(2) Reduction in road user cost
(3) Improvement in the vehicle fleet made possible by the road improvement
(4) Development benefits
(5) Transmigration benefits attributable to road improveme
(6) Employment benefits due to road construction/maintenance activity

In order to be operationally meaningful each of these benefits have to be quantified - even if we manage to arrive at only a first approximation.

Reduction in Maintenance Cost

This is easily quantified by comparing the maintenance cost required with and without the proposed investment in road improv

ment. The timing of the saving in maintenance cost is also obtained by comparing the maintenance cost with and without the proposed improvement and if a rate of discount is exogenously indicated, we can also calculate the benefit on this account in one figure - the sum of the discounted present values of the stream of savings in maintenance costs. The maintenance cost estimates, both with and without the improvements (corresponding to all construction options) have to be provided by the Costing Engineer.

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Reduction in Road-User Costs

The cost of transport is very much a function of the condition, and standard of the road; the age, Composition and Condition of the vehicle fleet; and the intensity and nature of the traffic.

Speed of the Vehicle

The expected speed of the vehicle is an important factor in determining the cost of transport, and speed is a function of the road condition and the traffic it is expected to cater to.

For any given road condition, the speed will decline as the traffic increases; conversely, for any level of projected traffic, the speed will depend on the facility the road provides.

Thus for a single lane road without adequate shoulders, the vehicle has to practically come to a full stop, in order to pass a vehicle coming from the opposite direction. Similarly it will be practically impossible for it to overtake another vehicle. If the road is widened or provided with shoulders strong and wide

enough to permit vehicles to go off the pavement to the shoulder to allow vehicles to pass or to overtake, then for the same level of traffic, the speeds will improve. Thus for various levels of traffic it should be possible to indicate reasonable speeds corresponding to each road construction option. This is a task of a Traffic Engineer.

It is also to be noted that apart from the road condition and traffic levels, the speed will also depend on the vehicle mix and the condition of the vehicle fleet. If the vehicle mix is improved or the vehicle fleet is modernised, the expected speeds would improve for a given road construction option and the level of traffic.

This is also the area where traffic Engineer will help out. To this aspect we shall however return presently.

Wear and Tear of the Vehicle

Apart from the speed, another critical factor in the determinati of transport cost is the wear and tear of the vehicle which of course depends upon the condition of the road. If the surface is poor, not only is the speed likely to be low but the wear and te of the vehicle will be more. Same will hold good if the vehicle has to go off the pavement often or if the vehicle has to slow down often. Not only the life of tyres, brake linings/brakes, engine life, in fact the life of the vehicle will be reduced wit inadequate roads, but also the fuel and oil consumption would be higher and same would apply to other elements in the vehicle operation cost. If the road is inadequate, the chances of accide increase, so would insurance costs.

Conversely the fixed costs, including interest and amortization cost, repairs, maintenance and depreciation, labour costs, taxes, insurance etc., as well as the variable costs, including fuel and oil consumption will all be lower, per ton-Km. or passenger-Km. as the road condition improves. Thus corresponding to each "Construction Option" and corresponding to the estimated traffic and speed, we have a set of vehicle costs in the determination of which we have to draw upon the expertise of an automobile Engineer/ Road transport expert. It will also be necessary to undertake a study to know what the present costs of transport are and the extent to which they can reasonably be expected to go down with each "Construction Option".

Traffic Projection

An important pre-requisite for the above, as in fact for determining the optimal level of improvement of a road link is the projection of traffic which the road link in question will be called upon to cater to over a period of years.

Projecting traffic is a complex task as, in essence, it involves projecting the economy which the road is expected to serve as also determining the share of the total traffic which will go to this road vis-a-vis competing roads and other modes of transport. The task is therefore two-fold :

(a) relating the road to the rest of the economy which it serves, including the quantum and origin and destination of the traffic by sectors and by locations; projecting future level of these economic activities by sectors of

the economy and by location and translating these economic projections back into transport requirement, and

(b) determine the expected intermodal distribution of these total transport requirements of the economy which the road-link is expected to serve.

Feedback Effects

Actually the task is even more complex, for investment in transport has a feed-back effect on the economy it serves, by acting as a catalyst, increasing the pace of development, and these in turn contribute to traffic generated. And different modes of transport have different "feed-back" effects - it is widely recognized that roads and road transport have larger "feed-back" effects than other modes of transport.

Regional Development Priorities

Incidentally it may be noted that in the projection of transport requirements, which involves projecting the economy it serves, we will also have to fully take into account the regional pattern of allocation of investments - in agriculture, industry, mining etc. which has been decided upon by the country based upon the regional development priorities of the Government - indicating the extent of preference which is to be given to various regions. In the writer's view, this is the way to translate regional priorities * into road development requirements - the investment in agriculture, industry mining etc. decided upon, say by Bappenas, would

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* See Appendix 2 for a discussion of various factors which might form a basis for determination of appropriate regional priorities/regional development strategy.

determine the need for development of transport, including roads, in various regions. It is neither necessary - nor desirable to impose a further regional priority constraint in determining how the total highway budget of the country would be divided into regional/provincial highway budgets.

Intermodal Distribution of Traffic

Since the task of projection of traffic involves determining the share of traffic that will go to our road-link under consideration vis-a-vis competing roads and other modes of transport (e.g. rail-ways, water-ways, coastal shipping, air transport, ropeway etc.) It is essential to know what the competition has to offer - i.e. cost of transport of other competing facilities as well as the quality thereof, not just at present but in future - over the period for which the traffic projection is being attempted. This is a difficult but nevertheless an essential task. Asking the departments dealing with these alternative modes of transport about the costs and the plans for these, is not adequate. In fact a coordinated joint decision has to be made as to which mode of transport should be developed to what extent and when, in order to cater to projected traffic in an optimal manner. And in determining the share of traffic which will go to any particular mode of transport, we have to bear in mind the user's choice - it is the total cost to the user which will be the determining factor for him to decide which mode of transport, or a combination thereof, he will choose. Transport cost i.e. the fare or the freight rate which the user has to pay, is only one element in his total cost. Also important are the cost of packaging, insurance, and,

most important, the quality of service (door to door services, speed of delivery and, even more important, the reliability of promised delivery time which by and large determines the inventory costs).

Period of Projection

Traffic projection has to be attempted over a period of years. Since it takes a few years to construct/improve a road facility and since a road, once improved, will have a life of ten years or more, and since it may not be practical to return to the sam road-link again for a major improvement/reconstruction, within say 10 years, it would be necessary to project traffic for at least 10 to 15 years. Projecting traffic beyond 20 years is neither desirable (as the discounted present value of a unit 20 years from now, with a rate of discount of 12 to 15% is negligible) nor practical (since it is very difficult to know with a reasonable degree of accuracy what the economy would loo like - which is to be served by the road-link).

Traffic Projection - Summing Up

It is an understatement perhaps to say that projecting traffic is a difficult task, yet it is an essential task - in which bot the transport economist and the traffic engineer have to help out. It involves, interalia,

1) undertaking studies of the economy which the road-link serves or is likely to serve over our period of projection
2) forecast the sectoral and location pattern of this Economy

3) undertake origin/destination surveys and interpret the data to establish links between the road and the economy it serves, and

4) undertake intermodal studies, including the study of costs and quality of alternative modes of transport.

5) it would also be necessary to know the regional/locational pattern of investment, by sector (agriculture industry mining etc.) and by region/provinces, decided upon, say, by Bappenas, and the regional priorities which the country wants to give to the development of various areas, since these would make additional demands on the transport facilities, including the highways.

6) "feed-back" effect of investment in transports and more particularly the highways on the economy relevant to the road-link and the additional traffic which this feed-back effect would generate also will have to be estimated.

The total projected traffic may therefore be considered to consist of three distinct categories i.e.

$$T = A + B + C$$

where T = total projected traffic

and A = the normal growth in traffic as the road link

B = the extra traffic generated as a result of higher/special investments in the area of the economy served by the road-link due to higher regional development priority attached to this area by the country

and C = the extra traffic generated due to the feed-back effect of the investment in transport on the economy served by the road-link.

Projecting A, though difficult, is nevertheless attempted as a routine. Projecting B is also not an impossible task, since it involves comparing proposed investments, say in Repelita II, with those in the past, in various sectors of the economy - agricultu industry, mining etc. in various regions/provinces of the econom so as to locate the areas where more than normal doses of invest ment are proposed and to consider the transport needs thereof an if our road-link is in that area, we must take explicit note of these extra investments.

Projecting C, i.e. the feed-back effect of investment in trans-port on the economy which our road-link serves must also be take into account explicitly, even if the quantification of this extr traffic is only a first approximation. If the present transport facilities are considered inadequate and impose bottlenecks and constraints on the smooth functioning and development of the economy, then, almost by definition, it follows that when the transport facilities are improved and the bottlenecks/constraints are removed, it must contribute to further development of the economy served by the improved transport facility which in turn would generate new traffic. In a developing economy, where in the process of development structural changes are bound to take place almost by definition, the feed-back or development effects of investment in transport must be explicitly taken into account, also in the form of newly generated traffic as a result of this

feed-back effect.

We shall further revert to this aspect when we discuss the quantification of development benefits.

Benefits due to Improvements in Vehicle Fleet

Discussed above was the question of quantification of benefits resulting from reduction in road-maintenance cost and road-user costs as a result of proposed road reconstruction/improvement.

As indicated, road user costs are, interalia, a function of speeds and road conditions, which again depend, interalia, on the traffic density and the type of traffic expected to be catered to by our road-link over a period of years.

The cost of transport to the economy is also a function of the vehicle fleet - its composition and its condition.

If the vehicle fleet is aged, and outdated, transport costs (and other costs e.g. environmental) are bound to be high, if on the other hand the vehicle fleet is modernised, these costs would be lower.

It has however to be noted that the vehicle fleet is also a function of the road condition.

A modern fleet of vehicles requires a modern highway system, otherwise it is just too expensive to run a new vehicle on a bad road - capable of only low speeds and high wear and tear. Similarly, if the highways and bridges are not strong enough to take the load of a large, high payload truck or tractor-trailer combination, it makes no sense to have modern heavy duty vehicles -

even though the transport costs would be lower if these vehicles could be economically used for carrying the traffic, but the road condition just does not permit it. Conversely, if the road system is upgraded and thereby permits the use of a modern vehicle fleet economically, then there will be additional benefit to the economy resulting from the upgrading of the road in the form of lower transport costs of a modernised fleet.

A question may be asked whether this benefit is not legitimately already a part of benefits calculated under reduction of road-user costs.

In the writer's view, in a situation like the one prevailing in Indonesia, where a half or more of the vehicle fleet is aged - over 10 years old or even over 20 years old, modernisation of vehicle fleet, made possible by the upgrading of the road system is a structural change rather than an improvement at the margin. These benefits due to structural changes are likely to be major and should therefore be quantified separately.

To avoid double counting, the benefits due to reduction in user-costs may be calculated on the assumption that the vehicle fleet would by and large remain like the one at present, and the benefits due to a substantial or a major modernisation of the fleet made possible by the upgrading of the highway system may be quantified separately.

To quantify these benefits we have to make a comprehensive study of the costs of transport by the existing fleet vis-a-vis a "modern fleet" corresponding to each "construction option" the

"modern" fleet being defined as the least cost fleet of vehicles consistent with the "construction option" i.e. which gives us the lowest cost of transport for a given projected quantum and type of traffic.

Development Benefits

In a developing economy, where almost by definition, the process of development involves structural changes, development benefits generated by a road improvement/construction may well be substantial. The quantification of these development benefit is something which can not be neglected or overlooked. In a fairly developed country, on the other hand, the improvements or changes in the economy are by and large quantitative rather than qualitative, improvements at the margin rather than structural. Thus the quantification of benefits from reduction in transport cost and road maintenance cost resulting from a road improvement may be the major benefits, rather than development benefits.

By development benefits, we mean the contribution made by the construction/improvement of a road-link to the development of the economy it serves.

Of course, a reduction in transport cost also makes a contribution to the development of the economy served by the road, but in certain cases, the contribution may be more direct. Thus, by providing a year round access in an area, where no access was possible, say, during the rainy season, a road-improvement may directly contribute to substantially increasing the agricultural produce, or may increase the income of the farmers by making it

possible for him to get better prices. In another situation, development/establishment of an industry or opening up a mine ma just not be possible without providing an adequate road-link.

The quantification of development benefits is a difficult task, though unavoidable.

The best way perhaps is to treat development as a product of a "package of inputs", road construction/improvement is just one o the joint inputs. For, roads do not produce development unless there is a development potential and other inputs are also being simultaneously provided. Thus for substantial increase in agricultural produce, other inputs such as water, fertilizer, improved seeds and knowhow etc. are also simultaneously provide along with an improved road access. Even for enabling the farme to get better price, marketing and storage facilities would nee to be developed.

Then fruits of development, jointly produced by a package of in puts, have to be allocated between various inputs is a matter where marginal productivity concept may have to be combined wit judgement derived from an indepth study of the economy serve b it. Thus, for example, the Construction of say Trans-Java road, which may not be justified by quantification of reduction in transport cost of the traffic carried by it, may well be justified if it brings about structural changes in the economy e.g. by acting as a catalyst for industrialisation of the island.

It may be noted that substantial development benefits may be generated not just by major projects like Trans-Java road but also by feeder roads or rural roads, or by provincial roads.

Intensive study of the economy served by a road-link is a prerequisite for efforts at quantification of development benefits.

Transmigration Benefits

In an economy like Indonesia where there are large variations in population pressures (Java with only 7% of the land area of the country supporting almost 70% of the population, with large areas with considerable economic potential lying practically uninhabitated), transmigration may well be the answer. In any case it would be an important element in the strategy of economic development of the country. For, through transmigration, not only the people who move are benefited but also the people left behind. With this migration, the population pressures of say Java would be reduced, so, the lot of people left behind in Java would also be improved. Thus, an improvement of a road-link in South Sumatra or Lampung would not only benefit the area in which it is located but also just as relevant is the benefit to Java if it helps transmigration from Java.

Transmigration benefit, like development benefits, are also the result of a package of inputs of which road construction/improvement is likely to be just one "joint output".

Other equally important or even more important inputs may be the explicit policy recognition of the Government, provision of necessary incentives, physical facilities for the migration and the economic promise that the attracting area offers.
But provision or an improvement of a road-link in the area may well be an important link in the chain, substantially contributi

contributing to the success of the transmigration effort, e.g. by providing employment in the construction/improvement and maintenance of the road network, improving the economic potential of the area or helping the area to realise its economic potential. For ultimately it is the economic attraction of the area, rather than anything else, which would determine the success or failure of the transmigration policy.

An important thing to remember in the quantification of transmigration benefits of a road-improvement is that these benefits have to be calculated not only for the area where the road is located or to which the transmigration is taking place or to the people involved in transmigration, but also in the area from where the migration is taking place and to the people who are left behind. The quantification of transmigration benefits therefore involve a study of both the areas - area from which the migration is to take place as also the area to which these people are migrating.

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Employment Benefits

In a labour surplus economy the generation of employment opportunities is itself an important objective of development and an essential ingredient of the development strategy. For, employment is perhaps the best mode of distribution of income, apart from the fact that providing employment may be a social and political necessity.

In a labour-surplus economy, with considerable unemployment and under-employment by definition, labour as a resource is being

wasted and use of labour may not only have zero or negligible real economic cost (certainly less than the money wage be paid) but stopping this wastage of an important national resource would have a positive value.

Stepping up of these economic activities which have large employment potential and which admit of using labour-intensive technologies thus becomes a good thumb rule of the strategy of development. And it is well recognised that road construction/improvement/maintenance activity offers more employment opportunities than perhaps any other economic activity. It is also a capital asset developing activity. The labour component of the expenditure involved in road construction/improvement/maintenance can be as large as 70 to 80%, far ahead of most other economic activities, if suitable labour-intensive techniques are used. * Since in the development process it would not be possible to concentrate only on those economic activities which have large employment potential since development of certain sectors (e.g. large industry), which are by nature capital intensive and offer little technological choice (labour intensive technology may just not be available or may be highly uneconomic), may also be necessary for balanced development, it becomes all the more important to make use of labour-intensive technology where it is possible and make use of this opportunity as much as possible by giving high priority to these sectors. Road development/maintenance activity, by its very nature is one of the few such econo-

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* See my article, "Employment potential of roads" published in "Employment and Unemployment Problems of the Near East and South Asia", Vol.II, Vikas Publications, New Delhi, 1971.

mic activity. Employment benefits of road-development/maintenance are therefore major benefits and the quantification of these benefits in a labour-surplus economy is therefore a must.

Since wage income along with profits and income from rents/quasi-rent, is an important component of national income in fact it is the major component, we might attempt a quantification of income generated as a result of direct and indirect employment generated by the road-improvement/maintenance activity as a measure of employment benefits of a road project.

For a further discussion of employment aspects of road improvement, Appendix 1 may be seen.

Quantification of Benefits - Summing Up

An effort was made above to explain in some depth the nature of benefits which may be generated by a road project and how these benefits might be quantified. The list of benefits is not complete nor would it be possible to follow a mechanistic approach to quantification of benefits.

The accent has to be on understanding how the proposed road improvement would affect the economy it serves, not just in the area/region where the road may be located but elsewhere as well.

An indepth study of the economy and identification of the relationship between the road and the rest of the economy is therefore essential and this is a major task in which the economist has an important role. There is a scientific method in quantification of benefits but it is also an art and not only the Economist's

skills and the tools of economic analysis but also judgements have to be used and these judgements may better be informed judgements. And to recapitulate, these benefits have to be quantified corresponding to each "construction option", for each road-link under consideration preparation of a national highway plan and determination of priorities in a rational manner is therefore not only a difficult task but also time consuming and a major effort, as it involves a lot of work.

An Optimization Model

With all the work that will have been done, we now have for each road-link L_i, the money cost Mij (for each "construction option" j) the economic cost Cij, and the corresponding benefit to the economy Bij.

Derived from these we have the total system money cost Σ Mij, the total system Economic Cost C, and the total system Benefits B, corresponding to various combinations of "Construction Options" for each road.

Budgetory Constraint Prescribed

The optimisation model involves maximisation of an objective function, say B/C ratio or B-C or Internal rate of return for the system as a whole within the budgetory constraint, exogeneously prescribed.

$$\text{Such that : } \Sigma \text{ Mij} \leq \bar{M}$$

where $\bar{M}$ is the budgetory constraint in money terms e.g. the highway development budget for Repelita II suggested, say, by Bappenas, and Σ Mij is the money cost of upgrading road-link L_i for a

construction option j summed up for all the road-links (i = 1 to N). for each road we take only one "Construction Option".

Thus where there are only two construction options (j = 1 or 2) and three road-links in our highway system (i = 1, 2, 3) then, we have the following alternative combinations of road-links and construction options :

No.1 $(M_{11} + M_{21} + M_{31}) = M_1$ (say)

No.2 $(M_{12} + M_{22} + M_{32}) = M_2$

No.3 $(M_{11} + M_{22} + M_{32}) = M_3$

No.4 $(M_{12} + M_{21} + M_{31}) = M_4$

No.5 $(M_{11} + M_{22} + M_{31}) = M_5$

No.6 $(M_{12} + M_{22} + M_{31}) = M_6$ and so on

Since $\bar{M}$ is the budgetory constraint exogeneously prescribed, we have to determine which of these is a "feasible" alternative.

Alternative 1 is "feasible" if $M_1 \leq \bar{M}$ similarly, alternative 2 is feasible if $M_2 \leq \bar{M}$ and so on.

Corresponding to each of these alternatives, we have the value of system B, system C and therefore system B/C, B-C, and internal rate of return for the system - values of B and C for the system are derived from individual Bij and Cij by adding these up for the relevant j in each of these alternatives (combination of various construction options for all road-links).

It is to be noted that values of B/C and B-C for the system cannot be calculated unless the rate of discount is exogeneously given. Internal rate of return does not require this to be given, in fact it indicates the rate of discount which equalised the $ sum of

present values of Benefits and Costs for the system as a whole.

Thus for each combination of construction-options for all road-links we have a system B/C and B-C if a rate of discount is exogenously prescribed and the internal rate of return.

We would calculate B/C, B-C or internal rate of return for only those alternative combinations which are "feasible" i.e. whose money cost is within the prescribed budgetory constraint $\bar{M}$.

Then out of 6 alternative combinations (when i = 1 to 3 and j = 1, 2), let us say only 3 are feasible viz. No.1, 3 and 5.

The corresponding money cost is M_1, M_3 and M_5; and the corresponding values of B/C are :

$$(B/C)_1, \quad (B/C)_2, \quad (B/C)_3$$

the corresponding values of B-C are :

$$(B-C)_1, \quad (B-C)_3, \quad (B-C)_5 \quad \text{and}$$

the corresponding values of Internal rate of return are :

$$r_1, \quad r_3 \quad \text{and} \quad r_5$$

Out of the three feasible alternative highway development programs viz. No.1, 3 and 5, we chose an optimal program i.e. the one which gives us the highest value of the optimizing criterion.

Thus, if the optimizing criterion is "internal rate of return", the optimal highway program is that one (among the three feasible ones No.1, 3 or 5) for which the value of internal rate of return is highest i.e. if among r_1, r_3 and r_5, r_3 is the highest, then No.3 is the "optimal" highway development program.

Optimizing Criterion

It is to be noted that the "optimal" program depends on the optimizing criterion; for each different optimizing criterion there is an "optimal" program - the "optimal" program may or may not be the same for different optimizing criteria.

Thus if instead of internal rate of return our optimizing criterion were (B-C) then, No.5 may turn out the optimal program (rather than No.3) if (B-C)5 > (B-C)3, and (B-C)5 > (B-C)1 : Similarly for B/C.

If we get different "optimal" programs, corresponding to different optimizing criteria, a question may be asked as to how does one chose "the optimal program". The truth of the matter is that there is no "the" optimal program, optimality is always a function of the optimizing criterion.

The writer's preference regarding optimizing criterion is in favour of "internal rate of return", since there are pitfalls in somebody exogenously prescribing the rate of discount - which is required to be given if (B/C) or (B-C) are to be used as optimizing criteria

On the other hand, if the rate of discount is given, then between (B/C) and (B-C), the writer's preference is in favour of (B-C) as the optimizing criterion - this would maximize the net surplus of benefits to the economy over the cost to the economy for a given budgetory constraint for the highway program. This would ensure that the net contribution made to the economy by a given budgetory allocation for highway development, in Repelita II say, is maximized.

Alternative Models

One can have alternative optimizing models, which are in reality, variations on the same theme.

Alternative I

Thus, if in addition to the budgetory constraint, which is in money terms, presumably expressed in Rupiahs, we have an additional constraint of foreign exchange allocation for the highway development program in Repelita II, then this constraint can also be added on into the above mentioned model.

Let Fij be the foreign exchange component of the cost of upgrading road-link L_i to the construction option j.

Thus the total foreign exchange cost for upgrading the system for all L_i (i = 1 to N) will be

Σ Fij for a combination of construction options for all road-link (we have ixj such alternative combination)

If the foreign exchange constraint, exogeneously prescribed, is called $\bar{F}$, (i.e. the maximum ceiling of foreign exchange made available for the highway development program is $\bar{F}$, expressed in $ say or in Rupiah equivalent if you like), then the foreign exchange constraint is Σ Fij $\leq \bar{F}$.

The model now becomes :

maximize : (B/C), (B-C), or internal rate of return for the system as a whole subject to the constraint

$$\Sigma \text{ Mij} \leq \bar{M} \quad \text{and}$$

$$\Sigma \text{ Mij} \leq \bar{F}$$

In other words we choose those combinations of construction options for all road-links which are "feasible" i.e. meet the requirements of both the constraints - the total budgetory constraint and the foreign exchange constraint.

Among those "feasible" alternatives, we choose that combination of "Construction Options" for all road-links, which gives us the highest B/C ratio, or highest (B-C) or the highest internal rate of return for the system as a whole.

Alternative II

Another variation on the theme is the case where the budgetory constraints are prescribed separately for each province.

The total highway development budget for the country say in Repelita II is first divided into the highway development budgets for each province,

so that $\Sigma \bar{M}_p = \bar{M}$

where $\bar{M}_p$ is the highway development budget for province p and $\bar{M}$ is the one for the whole country, both $\bar{M}$ and $\bar{M}_p$ are exogenously prescribed.

How $\bar{M}$ is divided up into $\bar{M}_p$ for each province is a separate question to which we shall return presently.

Alternative II-A

However, we assume that $\bar{M}_p$ is exogenously prescribed.

Then one way to determine an optimal highway development plan is to treat the province as if it were the country and optimize for each province separately.

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We then maximize (B/C), (B-C) or (r) for the whole country while the budgetory constraint for still to be satisfied for each province separately.

Thus : Maximize (B/C), (B-C) or r

Subject to : $\sum M^{p}_{ij} \leq \bar{M}_p$ for <u>each</u> province

i.e. $\sum M^{1}_{ij} \leq \bar{M}_1$ for province 1 <u>and</u>

$\sum M^{2}_{ij} \leq \bar{M}_2$ for province 2 <u>and</u>

$\sum M^{3}_{ij} \leq \bar{M}_3$ for province 3 and so on,

for all the provinces in Indonesia.

All these constraints have to be simultaneously satisfied in this variation of the model.

<u>Choice between the Alternative Models</u>

The "Optimal" plans resulting from Alternative models are not likely to be the same. Thus the question arises as to which one should be chosen.

Frankly, every time a constraint is introduced, there is a cost - in the form of a deviation from the "optimal" without this constraint.

Introducing provincial budgetory constraints over and above the national budgetory constraint will give us the "optimal" which is different from the one we would get without the provincial budgetory constraints.

This would mean that in certain provinces, where we have relatively generous allocation of funds for highway development under our exogeneously prescribed provincial budgetory constraints, we would take up roads with lower B/C, (B-C) or internal rate of return and <u>not</u> take up roads with higher economic return in another province,

which means that because of these exogeneously prescribed provincial budgets, we get a lower economic return for the total expenditure on highway development for the country than we can get without these separate budgetory constraints for provinces prescribed exogeneously. This is measure of the cost of deviating from the "optimal" for the country as a whole.

A justification, often advanced, for prescribing provincial budgets is in terms of regional development priorities.

The argument goes something like this : For the maximum development of the country from all angles - economic, social, political and strategic, we have to have a regional development policy which naturally allocates higher priority to the development of a particular province (as against another one).

A higher priority for a province would be clearly justified even if the total development for the country as a whole is at a slower pace; the price paid in the form of lower economic development is more than compensated for by gains on the Social, Political or Strategic fronts.

In fact for optimal and balanced development of the economy also, we need to have a locational strategy, allocating varying degrees of explicit priorities for development of certain regions which have the necessary economic potential. In the longer run this policy would lead to faster development of the economy. Thus this policy is justified on purely economic grounds as well.

So far so good. The argument, however, goes on :
Higher regional development priority allocated to a province should

also a higher allocation of funds for the development of highways in that province over and above the funds required for meeting the highway needs arising out of higher investments in agriculture, industry etc., reflecting the higher priority allocated to this region under the regional development policy of the country. Another way of saying the same thing is that we should take up roads for development with a lower B/C ratio (or B-C, or r) in a province where a higher priority under regional development policy at the expense of one with a higher B/C etc. in another province.

This is what the writer finds difficult to accept. Regional Development Strategy and the priorities, should reflect themselves in the allocation of investment to agriculture, forestry, industry, mining etc. in each province (and not in highways directly); highway development programs should be decided upon in such a way as to cater to the highway requirements of the increased investments in agriculture, mining, industry etc. in these provinces - adequately and in an optimal manner. No separate regional priority is required for highway development by province. In fact, if over and above the regional development priorities indicated in the shape of quanta of investments in productive sectors such as agriculture, industry etc., we have regional priorities for highway development as well, these two might not be mutually consistent or, the regional priorities allocated for development of highways may not be adequate for meeting the highway needs of traffic corresponding to the allocation of investment in productive sectors by provinces reflecting the regional strategy of development.

In the writer's view, therefore, the model which optimizes for the country as a whole without prescribing the provincial highway

budgets but rather a single budgetory constraint for the country as a whole would be better.

But if the provincial budgets are exogeneously given and insisted upon, then the writer's preference would be for model IIB, where maximization of the objective function is done for the country as a whole (rather than Model IIA where maximization is done for each province separately).

Determination of Highway Development Budget for an Optimal Highway Development Plan

For the above models, the Highway Development Budget is exogeneously prescribed. We can turn around the problem and ask ourselves the question as to how to determine the optimal highway development budget i.e. what will be the order of funds required to develop the highway system of the country to an optimal extent (i.e. to meet the highway needs of the economy in an optimal manner).

It is necessary to know the answer to this question even if one were certain that the order of funds required would not be available. For, those, who have the difficult task of prescribing the budgetory constraints for highway development plans in Repelita II say, Bappenas, would want to know what the "optimal" requirement is and the extent of the cost to the economy when adequate funds are not provided.

We have for each road-link in the country Li, the money cost of upgrading to the construction option j, i.e. Mij; the Economic Cost Cij corresponding to the Mij; and the corresponding Benefits to the economy Bij.

For each road-link Li, we determine the optimal level of development i.e. that construction option which gives us the highest value of (B/C) or (B-C) for the road-link or the highest internal rate of return.

Since there is no exogenously prescribed Budgetary Constraint, each "construction option" or level of development of the road-link is "feasible" with its corresponding money cost, economic cost and economic benefits. We choose the best construction option i.e. one which will maximize the value of our objective function (optimizing criterion - B/C, B-C or r). The corresponding money cost of this construction option for this road-link $\bar{M}i$ will give us the requirement of funds for optimal development of this higyway (road-link) (we may note that the "best" construction option may well be do-nothing option for some road-links). When this excercise is done for all road-links and $\bar{M}i$ determined for all i, we add up the requirement of funds for all road-links to give us $\bar{M}$

$$\text{i.e. } \Sigma \bar{M}i = \bar{M}$$

Thus $\bar{M}$ gives us the total requirement of funds for an optimal highway development plan and the basket of $\bar{M}i$ indicating the optimal level of development for each highway link gives us the composition of the optimal Highway Development plan for Repelita II, say. This "optimal" highway development plan has been worked out on the assumption that the funds are no constraint. Nor is the capability to implement road works of this order considered any constraint. In reality, of course, either of these, or both, the constraints may be effective, in which case we revert back to the optimization mode.

It is, nevertheless, of considerable value to know the extent of

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funds required for, and the composition of, an "optimal" highway program on the assumption that these constraints will not be [illegible].

We can perhaps think in terms of implementing the program over a longer period and/or make an attempt to find more funds, since we know the cost of taking up a smaller road development program in the form of real benefits lost to the economy and these are quantified.

Conclusions and Recommendations - Studies and Data Required and Who is Expected to Provide Which Data

An attempt was made to present above an approach to highway planning i.e. to answer in a rational manner the question as to which road-link should be developed to what extent and when-under various constraints and when there are no such constraints.

In the process we indicated the studies which will need to be undertaken and the data which will be required and who is expected to provide which data.

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Broadly the studies are of four kinds :

(a) An in-depth study of the economy which the highways are expected to serve - with a view quantify the benefits from road improvement and to help project the traffic.

(b) A study of alternative modes of transport - including the cost and quality thereof and

(c) A detailed study of highway transport industry including

how the highway transport costs vary with different road conditions and fleet modernization and

(d) A study of costs of improving the highways from their present condition to various levels of "Construction options", including the question of "Choice of Technology

In the process many sub-studies are required, including :

(1) A thorough study of the present condition of the highways.

(2) A detailed study of the traffic catered to by the highways at present - including traffic counts and O/D studies linking the traffic with the economy served by the highways.

(3) A study of how the speeds will vary with different levels of highway development i.e. "Construction Options".

(4) A study of how the speeds will vary with different levels and composition of the traffic.

(5) Quantification of the cost of upgrading the road system to various "Construction Options" and various components of this cost - e.g. labour component, foreign exchange component, machinery and equipment required etc., and deciding on "The Choice of Technology" question

(6) A study of the present condition of the economy served by the highways and the plans for investment in agriculture, industry, mining etc. by province, reflecting

the regional and sectoral strategy of development adopted by the country.

(7) Intermodal studies and transport strategy adopted by the country and more specifically,

(8) Study of Highway transport costs.

This is not a complete list of the studies/sub-studies required but it does indicate the kind of work that has to be done for a rational planning for highway development.

Studies at (1) and (5) above are the main concern of Highway Engineers who must provide the necessary data.

Studies at (2), (3) and (4) are similarly the main task of the Traffic Engineer.

Studies at (6) are mainly for the economists in Bina Marga in collaboration with economists elsewhere including Bappenas etc. though in the projection of traffic the Traffic Engineer also has an important role.

Studies at (7) have to be conducted in collaboration with Ministry of Communications, TCAS, etc. and, for the studies at (8) we need the help of an automotive/vehicles Experts along with the experts in Ministry of Communication dealing with highway transport and others in the industry.

Besides these, we may need a computer expert who can help out with the numerous computations which will be required.

Since armchair studies would be rather inadequate, it would be

[illegible] to undertake on-the-spot studies, involving extensive travel.

[illegible] for studying the present condition of the highway system and [illegible] the cost of upgrading each of these to various levels of "Construction Options", teams of Engineers would have to be [illegible] here applies to studies of speeds - present and those [illegible] to various levels of traffic and "Construction - options".

Similarly, for studying the relationship between the highways and the economy served by them; for projecting the economy and the traffic and for [illegible] detailed studies of the present condition of the economy, its economic potential and the plans and programmes of development by sector and by province will have to be undertaken which will involve sending teams to each province to collect the necessary economic data. Special focus will also have to be given for the areas where transmigration benefits or development benefits are likely to be significant.

All this is a major task but fortunately a beginning has already been made with provision of a skeleton staff within Bina'Marga [illegible] in the directorate of planning.

The present set up needs to be substantially strengthened and, equally important, the existing staff should be vigorously utilized to get on with the task.

The result should be an getting the work done mainly by the people in the Bina Marga - with the help of others in other Government

departments and UNDP/TCAS people attached to Bina Marga/Min. of Communications, rather than studies contracted out to outside Consultants.

Even if the work done by people within Bina Marga is not as perfect as might be done by outside Consultants, still the knowledge acquired and the expertise developed in doing the work - with the assistance of UNDP/other "experts", would have considerable value from the longer term viewpoint of self reliance. On the other hand if the work is assigned to outside consultants, we might get better quality reports - which might bring in more funds from foreign sources, and this is of value particularly in the short-run, still we get only reports - which may decorate the shelves but their value in developing the expertise within the country is likely to be limited. It has to be conceded that it may be unavoidable and in fact necessary to contract out to outside consultants certain studies - whether for feasibility or detailed engineering, still, in the writer's view the accent should be on developing the "expertise" within the country. And now is the time, since (a) we already have a shelf ful of reports prepared by outside consultants; (b) major road-links have already been studied and (c) we are now embarking on a major "highway-betterment" program.

It is recommended that we begin collecting the data and undertake the studies indicated also to start strengthening the organisation, without delay.

Acknowledgements

During this period of about six weeks, my attempt was to familiarize myself with the Indonesian economy, Indonesian Highways and

the highway planning problem in Indonesia.

In this context, I was glad to be invited to the meeting convened and chaired by Minister Emil Salim on 15 May 1973 to discuss the first draft of "Forecast of Commodity flows by regional origins and destinations for Repelita II Transportation Planning". At this meeting I was able to gain a first hand knowledge of Governments economic planning policies as this meeting was attended by various senior officers and experts from various Government departments dealing with different aspects of the economy.

I am also glad to have had the benefit of the attending the meeti Convened and chaired by Ir. Sunkean Secretary Bina Marga on 16 May 1973 to review the interim report on Lubuklinggau-Tolukbetung Highway Feasibility Study.

Another meeting deserving Special mention was the first regular planning meeting on 29 May 1973, chaired by Ir. Surjatin, Director of Planning, Bina Marga, and attended by Ir. Hasibuan, Ir. Rublan, and others. It was at this meeting that I presented outlines of the model for determining optimal allocation of funds for each road-link within a budgetory ceiling as also the determination of the budget required for optimal development of the highway system. The comments and the discussion were indeed enlightening and rewarding.

I also wish to acknowledge here my indebtedness to Dr.Morton Grossman of the IBRD Resident Staff, Dr.Papanek of Harvard Advisory Group and Mr.Griffiths of TCAS who were good enough to

find time to educate me a little about various aspects of Indonesian economy.

Last, but not least, I wish to express my gratitude to my colleagues on the Highway Planning Coordination Project namely, Messrs F.J.Chudley, Francis Baquero and Bengt Osterlin who have been very generous and helpful. I have learnt a lot discussing with them the various issues from time to time.

VS Bhatia

(Dr.V.S.-Bhatia).

Highway Planning Coordination Project

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Unemployment and Highway Development

Unemployment is a serious problem in labour-surplus developing economies. Employment generation is therefore one of the important objectives of development effort.

In determining allocation of investment in different economic activities, benefits resulting from employment generated, both direct and indirect, must be explicitly taken into consideration otherwise it becomes a cliche, and it is not an operationally meaningful statement, when one states that solving the problem of unemployment is an important goal in developing countries. This objective must be built into the decision-making process.

Investment in Transport Sector makes an important contribution to the goal of generating employment (directly and indirectly) apart from acting as a catalyst for the development process as a whole.

And within the transport sector, some modes of transport generate larger employment than others.

Development of Roads and Road Transport makes a larger constribution in terms of direct and indirect employment generated than perhaps any other mode of transport.

The reasons are found in the technology itself. Thus the labour component per unit of investment (say Rupiahs or dollars per km) in road construction/improvement can be quite large particularly when one uses labour-intensive techniques of road construction/improvement (it can be as high as 70 to 80 % or more. This includes direct labour component, plus labour component in materials

used in road construction improvement, transport of materials etc.). Similarly, direct employment generated in operation of road vehicles i.e. the number of people required to run and look after a vehicle is also generally high (about seven persons per truck). The corresponding figures for other modes of transport, and in fact most other economic activities, are lower.

If "employment generation" is to be more than a cliche and is really an important objective of development effort, then, the quantification of benefits resulting from employment effects of investment must be built into the methodology itself.

The Economic rate of return of investment, in terms of benefits and costs to the economy, has come to be accepted as a valid criterion for deciding on allocating investment. The employment effects of investment must therefore be explicitly included in the calculation of costs and benefits to the economy.

This can be done by using not the money cost of investment but rather the real cost to the economy. In a labour surplus economy money wages paid do not reflect the true cost of labour if the labour used is otherwise unemployed or underemployed. The true cost of labour is zero if the labour used would otherwise be unemployed. In the situation of underemployment, the opportunity cost of labour may be taken as the true cost of labour. By opportunity cost we mean the value generated by this labourer in the economic activity in which he is now employed (under-employed). This is conceptually the reduction in production resulting from withdrawing this labourer from his present employment, everything

else remaining the same. It may be noted that in many cases in labour-surplus economies, the "opportunity Cost" may be negative, i.e. by withdrawing him, the productivity of those left behind may in fact increase. This is, of course, the logic of transmigration - by moving some people from crowded Java to less crowded Sumatra, the people left in Java are better off, as also the people who migrate.

It should not be surprising therefore, if in a labour-surplus economy the real cost of labour is zero or even negative.

Any calculation of costs (for the purpose of allocating investment between different economic activities or between alternatives within the same sector) which uses money costs of labour component instead of real costs of labour is bound to result in inefficient allocation of resources.

Similarly in the calculation of benefits for working out the economic return earned by the proposed investment - the benefits of direct and indirect employment generated by the investment must be explicitly quantified, otherwise it would lead to inefficient allocation of resources.

The logic of this approach lies in the fact that wages paid are in fact an important component of "national income" generated. Thus although for private entrepreneurs return from investment in the "profit" earned, for the economy as a whole, the "return" is the total income generated i.e. wages plus profits (including rents and quasi-rents). Maximisation of national income generated by the proposed investment, rather than mere maximisation of profits

for the entrepreneur becomes the explicit objective from the national view point -particularly if employment generation is one of the objectives of the development effort. This approach has wide implications - particularly in the choice of technology - labour - intensive/intermediate technology automatically gets preference, and in the process indigeneous talent gets preference over foreigners, particularly from developed countries, who are used to working with capital (and expensive management) intensive technologies.

Thus, for example, with this approach, domestic contractors, with the help of domestic labour, would get preference in Road Construction/Improvement, over foreign contractors who would normally be used to highly mechanical methods. Since no foreign contractors are likely to be interested unless they earn a net profit of 10 to 15%, with domestic contractors this component would also remain within the country, thus resulting in the saving of equivalent amount of foreign exchange, which is also a precious scarce resource.

There will be a whole range of indirect benefits, if labour intensive technology is chosen as a result of proper quantification of Benefits and Costs to the economy as suggested.

Thus, since labour-intensive technology is likely to be less suitable for prestige roads - expressways and the like, this approach would also result in larger investment in "Highway-Betterment programs" and rehabilitation and reconstruction of existing road network.

Another benefit of using labour-intensive technologies would be that designing and supervision of road improvements/construction would be easier and therefore the need for expensive foreign consultancy services would be reduced and the scope for using and developing indigenous consultancy services would be increased.

This has considerable value - particularly from the viewpoint of the long term objective of self-reliance.

Besides, foreign consultants are rather expensive (and their methods of road construction are expensive - no doubt the quality of work would also be better); it may therefore be better to save something on this account and use it for road development instead.

APPENDIX 2

Treatment of Regional Development Priorities

Due to certain socio-political reasons, the Government may give higher priorities to the development of certain regions than others. Thus, a more balanced regional growth or reduction of economic disparities between different regions can be an explicit objective of Government Policy.

In fact, explicitly defined regional strategy of development is a necessary component of the strategy of Development adopted by the country even from a purely economic view point - though, of course, social, political and strategic aspects are considerations which may require a deviation from an economic optimum.

A number of considerations may form the basis for deciding on the priorities which the Government may give to different regions.

These may include :

(1) Relative backwardness

(2) Relative economic potential

(3) Relative local will to develop, etc.

All these factors need to be quantified in some way, if these are to be operationally meaningful. The following aspects may be relevant in this connection :

Relative Backwardness

(a) Physical infrastructure

(b) Social Infrastructure

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(c) Administrative capacity

(d) Per capita income and

(e) Present income distribution.

One of the important considerations in allocating higher priority to a region may be because the region is relatively backward (though it may nevertheless have high economic potential). It is therefore necessary to find a way to determine the extent to which the region is relatively backward and in this, the above-mentioned factors may help us.

Physical Infrastructure

This would include the stage of development of communications and other infrastructure such as power, irrigation facilities etc. Communications facilities would include length and serviceability condition of road network, and road vehicle fleet, other modes of transport such as inland waterways and inland water transport facilities, coastal shipping and ports, airports and air services, railways and other communications facilities. We would also include tourist infrastructure in this category.

Social Infrastructure

This would include the present literacy rate, level of education and, educational facilities available - quality and quantitative aspects, medical care facilities, health and hygience levels, life expectation, family planning facilities and usage thereof, present birth, fertility and death rates, etc. We would also include law and order situation in this category. The stage of

development of trading facilities, insurance, banking, other services might also be included here.

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Administrative capacity of the region

In addition to the physical and social infrastructure of the region, we may also consider the administrative capacity - or the administrative infrastructure - of the region in determining its "relative backwardness".

By administrative capacity, we mean whether the region has the necessary administrative apparatus to help the region to bridge the gap between its present economic and social levels and its own development potential. This category will therefore include the number and quality of its Public Administration personnel, their present levels of integrity/corruption and the potential to improve upon it, the present real wage structure of Public administration personnel, the facilities they are provided for meeting their personal/family, and official, needs, and the like.

Per Capita Income

Present levels of per capita real income would normally be considered a good index of relative backwardness and is relatively easily quantified. Also important for our purpose, however, are the sources of income generation, say, by sectors, such as agriculture, industry, trade and commerce, mining and processing of minerals, and services.

For, not only the levels or per capita income, but equally the way

the income is generated, is important to determine the relative backwardness of the region. Generally speaking, the greater the development of industry and processing activity including that of agricultural produce and oil/minerals/forest products, the less the relative backwardness of the region.

Distribution of Income

Similarly, along with the levels and sources of income, the patterns of distribution of income are also important for determining the "relative backwardness" of the region. The more the income is distributed widely, as against its concentration in the hands of a few privileged people (indigeneous or foreigners), the less "Backward" the region. For this purpose it would be necessary to study the land-holding patterns-by size and quality of land holdings, and land-less people, wage earners, self-employed, and the patterns of employment and earnings, size, type and ownership patterns of industrial units, mines, and trading activities, etc. It may also be useful to survey the consumption and savings patterns in the region to get some idea of the pattern of distribution of income and the "relative backwardness" of the region.

Relative Economic Potential

Relative backwardness can not be the only criterion for determining the regional development priority; also important is the relative development potential of the region. If the region is "backward" but has little "development potential", it would

perhaps lead to wasteful use of scarce investment resources if we pour large amounts of money into this region. The following factors are among those which would help us determine "relative economic potential" of the region.

(a) Natural resources

(b) Human resources

(c) Marketability and

(d) Export potential of the region.

Natural resources and Human resources

The extent of availability of natural and human resources will by and large determine the development potential of the region. Natural resources may be defined to include the extent and quality of agricultural/forestry land, including the potential for development of cash crops, - tea, coffee, cotton, rubber, tobacco, sugar, spices etc. Fishery and marine products potential in the surrounding sea area, and availability of oil and minerals such as coal, iron ore, copper, tin, bauxite, atomic minerals, nickel, gold, marble, stone, valuable sands, etc. The mountains and lakes are also valuable resources as on them depends partly the hydro-electric power and irrigation potential. Also important is under-ground water and rainfall - quantum and timing thereof.

While it is true that there are a number of "developed" and rich countries/regions without any natural resources worth mentioning, it is equally true that availability of "natural resources" is a considerable help particularly in the earlier stages of develop-

ment. The countries which have less natural resources have to make up for it through higher development of their "Human Resources" - they have to be at the fore-front of Technology and spend a larger part of their capital/investment resources in "Research and Development" - with a view to continually push the technological frontiers, thereby gain a certain monopolistic advantage through patents and "intellectual property". "Human Resources" would include the levels of population, population density, the educational levels of the population, capital investment in human beings, etc. A "relatively backward" region is likely to be relatively backward in Human Resources, but a relatively thickly populated region has however certain advantages to offer, viz. cheap labour, which is a hole and is a positive factor in determining the economic development potential of the region. "Natural Resources" and "Human Resources" together, therefore by and large determine the development potential of the region.

Marketability and Export Potential of the Region

While Natural & Human Resources together determine the production-potential of the region, the actual development can not materialise unless a way is found to market the potential production - either internally - within the region, or externally - i.e. by exporting it - either to other regions within the country or to foreign countries.

Marketability/export potential depends upon (a) the quantum and pattern of Demand in the potential consuming area, and (b) the relative competitiveness of this region vis-a-vis its competitors

in that particular market - which depends interalia on the costs and quality of the products as well as its ability to market the produce (which depends on the level of development of its human resources). While the demands are by and large exogeneously determined and depend upon the levels of income and tastes of the consuming area, the ability to capture a suitable share of the market depends on the natural and Human Resources of our region, under consideration.

The success of the region will partly depend on its ability to produce those commodities which it can successfully market/export (with profit). "Relative Economic Potential" of the region is therefore important in determining the priority which might rationally be allocated to the region; in fact, relative "backwardness" of a region has meaning only in relation to the region's own "development potential".

Relative Local will to Develop

Apart from relative "backwardness" and "development potential of the region, it is also relevant to include "Relative local will to develop" among the considerations for deciding on the priority which should be allocated for the development of a particular region. The following would be among the factors which might help us quantify the "local will":

(a) Provincial/Local Government's taxation effort- including the will to tax its people;

(b) Provincial/Local Government's will and ability to use rationally the tax resources so collected -

i.e. on a rational economic basis rather than purely on political or other considerations; and

(c) The region's self-help experience.

At the provincial/local levels, the temptations are great to arrange things in such a way as to cause least inconvenience to the local people - particularly the influential sections thereof (who, in fact, are the people likely to play an important role in Governing at the provincial/local level). Thus the temptation is not to tax at the provincial/local level but rather to depend on the funds obtained from the Central Government. The temptation is also there to use public funds in such a way as to benefit themselves or the influential sections of the society rather than on a rational economic basis - e.g. by building a road near the house (a farm or business premises) of an influential family of the region or an irrigation channel providing water to their farm, etc.

Similarly local self-help experience would be relevant in this respect. It is therefore important to include "relative local will" explicitly among the considerations for deciding on the "priority" to be allocated to the region, if for no other reason, at least as an incentive to develop the "local will".

Regional Development Priority and Highway Budgets

On the basis of above mentioned and other considerations one can develop a rational approach to determining the priority to be allocated to each region in the country. This priority will how-

ever reflect itself in the distribution of investment resources to each region in each sector. Thus we shall end up with allocation of total national investment in agriculture say, by figures of investment in agriculture in each province/region, similarly in mining development including oil, in industry etc. A question arises as to whether it is necessary or desirable to have a separate "regional priority" factor for distributing the allocation of national highway budget (say in Repelita II) between various provinces/regions.

The question that is being posed here is the following viz. (a) should we consider transport as a service and therefore determine the requirement of funds for say development/betterment/maintenance of Highways in each province/region so as adequately to meet the traffic requirements of economic activity of the region resulting from the investments in agriculture, industry, mining etc. in the region decided upon on the basis of the development priority allotted to that region, or (b) should we also have a separate factor of "regional priority" for distributing total Highway budget between provinces/regions, and having so decided on the provincial Highway budgets, we should then allocate it to different road links in the province within the ceiling of provincial highway budget on the basis of economic criteria (e.g. benefits-Cost analysis).

The writer is of the view that the correct course to follow is (a) above and not (b), because (a) already takes care of the "regional priority" decided upon by the country, to introduce it again for

distributing the national Highway budget into provincial highway budgets is likely to distort the pattern of highway development and deviate from the rational pattern. If course (b) is followed, we may end up with development/improvement of a road-link of a lower economic priority, just because it happened to be in a province which got a relatively larger budgetory allocation, at the expense of another road-link with higher economic need in another province. Apart from the fact that this approach, (b), is likely to lead to less than optimal use of the total highway budget it may also be counter-productive in the sense that the highway needs consistent with the regional allocation of investment in agriculture, industry etc. (which already reflects regional priorities decided upon by the country) may not be fulfilled in some regions/provinces because we again introduced a regional priority factor in distributing the total highway budget between various provinces and thereby ended up with a different regional pattern of allocation funds for highway development than that required, or consistent with, the regional allocation of investment in agriculture, industry etc.

We dealt with this aspect, when we developed a formal optimizing model for determining the allocation of funds to each road-link.

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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

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OFFICE OF
THE ADMINISTRATOR

A.I.D. Loan No. 497-T-036
AID-DLC/P-2056

LOAN AUTHORIZATION

Provided from: FAA §103 ("Food and Nutrition")
(Indonesia: Aceh Road Betterment Project)

Pursuant to the authority vested in me as Administrator, Agency for International Development by the Foreign Assistance Act of 1961, as amended, (the "Act") and the Delegations of Authority issued thereunder, I hereby authorize the establishment of a loan pursuant to Part I, Chapter 1, Section 103, and Chapter 2, Title I, the Development Loan Fund, to the Government of the Republic of Indonesia ("Borrower") of not to exceed Ten Million Three Hundred Thousand Dollars ($10,300,000) to assist in financing the local currency costs and certain foreign exchange costs for technical advisors of a road and bridge betterment project in Aceh province in Indonesia, this loan to be subject to the following terms and conditions:

1. Terms of Repayment and Interest Rate

The principal of the loan shall be repaid in full by the Borrower forty (40) years from the date of the first disbursement under the loan, and such repayment shall include a grace period of not to exceed ten (10) years from the date of first disbursement. The interest on the loan shall be paid by the Borrower and shall accrue on the outstanding balance of the principal and any due and unpaid interest at the rate of two percent (2%) per annum during the first ten years from the date of first disbursement under the loan and at the rate of three percent (3%) per annum for the remaining thirty years.

2. Currency of Repayment

Provision shall be made for repayment of the loan and payment of the interest in United States dollars.

3. Other Terms and Conditions

a. Unless AID otherwise agrees in writing:

(1) Equipment, materials and services financed under the loan shall have their source and origin in Indonesia or in countries included in AID Geographic Code 941.

(2) As a condition precedent to the initial disbursement under the loan, the Borrower shall provide its written assurances that, except for the U. S. dollar costs of the U. S. technical advisors, 100% of the estimated annual expenditure for the Project will be made available in advance to enable the work to be initiated and to proceed on schedule.

b. The loan shall be subject to such other terms and conditions as AID may deem advisable.

John E. Murphy
Deputy Administrator

6/28/74
Date

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Department of State

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E.O. 12065: N/A

SUBJ: ACEH ROAD BETTERMENT PROJECT UPDATE-LOAN 497-T-036

REF: A) STATE 070929: B) JAKARTA 3977

1. REFTEL B TRANSMITTED THE OVERALL PROGRAM TO RESTRUCTURE THE SUBJECT PROJECT TO EXPEDITE THE COMPLETION O THE ROAD. WHTHIN THAT FRAMEWORK, THE TAPAKTUAN-KRUENGLUAS SECTION, REFTTEL (A), REMAINS A SPECIAL ISSUE FOR BINA MARGA AS CONSTRUCTIN ACTIVITY HAS LONG CEASED IN CONTRAST TO THE IMPROVED CONTRACTOR PERFORMANCE ON THEOTHER TWO ROAD SECTIONS.

2. BINA MARGA WOULD PREFER TO NEGOTIATE DIRECTLY WITH A JOINT VENTURE OF NINDYA KARYA AND RSEA OF TAIWAN TO TAKE OVE THE TAPAKTUAN SECTION AS THE MOST EXPEDITIOUS MEANS OF REACTIVING CONSTRUCTION. USAID HAS REMINDED BINA MARGA THAT USE OF AID FUNDS FOR REIMBURSEMENT OF CONSTRUCTION COSTS WILL ONLY BE PERMITTED WHEN AID CONTRACTING PROCEDURES ARE FOLLOWED. HOWEVER, THE AID LOAN FUNDING OF CONSULTANT SERVICES WOULD NOT BE AFFECTED.

3. BINA MARGA IS TAKING THE AID POSITION UNDER ADVISEMENT. CONSULTANT CONTINUES TO PREPARE DOCUMENTATION FOR RESTRUCTING ROAD SECTIONS AND RETENDER PER REFTEL (B). THIS WOULD REDUCE THE TAPAKTUAN-DRUENGLUAS OF 96 KM TO A MORE REASLISTIC SECTION OF 60 KM. CORRESPONDING REDUCTION OF OTHER SECTIONS WOULD OCCUR. WILL KEEP AID/W ADVISED.
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Peter Bloom
x 27327
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FROM: SecState WASHDC

TO: AmEmbassy JAKARTA

SUBJECT: ACEH ROAD BETTERMENT - IRR

REFS (A) TOAID A-30; (B) STATE 037593

1. Asia Advisory Committee meeting held March 20 on Aceh Road Betterment IRR. Document reviewed omitted even general information on number of points considered essential for authorization to proceed with project development and analysis. Nevertheless, AA/ASIA authorizes Mission to continue work, including preparation of CAP, on understanding that Mission will transmit by cable soonest, and in any event before completing CAP, following information:

(A) Description of population(number, distribution, and density) in project area;

(B) Types of economic activity in area, including available data on occupational breakdown of population and income distribution. Why area selected for road improvement? Population group likely to benefit from project, including size and income level. Benefits (income and otherwise) expected to flow from project;

(C) Information on present agricultural production in Aech, supporting data for assumption that Aech is potential food surplus area, rationale for assumption that agricultural production will increase as a result of road project, and market areas to which surplus would be exported from project area.

(D) Description of source and type of data that are or will be available as basis for selection roads and structures for repair, upgrading, or new construction. Description of methodology and how applied in determining level of improvement, costs, and benefits. To extent possible, cite examples of road sections likely to be included illustrating method for selection, and describing technical/economic analysis based on UNDP study. Please send one copy, preferably three, of UNDP report as soon as available.

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(E) ~~(B)~~ Information available on how current road work in Aceh - improvement, reconstruction, new roads -- is carried out: organization~~ally~~, budget, physical. What is current road maintenance picture in Aceh -- facilities, organization, personnel, budget, results; does specific maintenance element need be included in proposed project?

2. We assume that most of information described above is by now readily available at least in outline, and that it would support selection of Aceh as project area and provide rationale for undertaking project. Its prompt submission would enable us to determine whether decision to proceed requires review and whether list of items suggested for inclusion in CAP (see following paragraphs) needs to be supplemented. The information to be cabled now should of course also be included, in ~~adequate~~ detail, in CAP.

3. In addition to items raised para 1 above, other issues which need be addressed in CAP include:

(A) Statement on scope of technical services, including proposed role in institution building at both provincial and national levels and on actual physical project implementation. Query whether advisors are to be used ~~to assist~~ in improving maintenance capability in Aceh Bina Marga - if so, should be part of discussion on scope of services.

(B) A clarification of references to Aceh as a "sparsely populated", "labor scarce" province. More precise data concerning Aceh population and labor availability should be gathered to support decisions affecting use of relatively equipment-intensive construction alternative for betterments. If, as indicated in ~~paper~~ IPR, labor in short supply and traditional construction methods in Aceh are labor intensive, request you include evaluation prospects implement project ~~in~~ to proposed timetable. Also provide detailed comments on labor/equipment mix including how equipment requirement will be supplied and what commitment obtained from GOI to ensure

equipment availability.

(C) An implementation plan covering in ~~some~~ detail how work to be accomplished, time schedule for design and construction on roads segments and bridges, phasing of technical assistance, proposed yearly budget over life of project.

(D) Problem of maintenance: (i) current, (ii) both during and (iii) after completion of road and bridge improvements. It evident maintenance has been serious problem resulting in part from inadequate staff and budget. It key that steps be identified which necessary assure upkeep of improvements. CAP should include presentation evidence, if any, that Bina Marga prepared attack problems -- institutional, budget, physical.

(E) Procedures and documentation to be required certifying work, or portions of work, satisfactorily completed to permit reimbursement, including possible role technical advisors in this process. Role of USAID in monitoring project to insure proper compliance with specifications includes quality control and inspection.

(F) Role of World Bank and Japanese in road betterment program, including any impact on institutional aspects.

4. Technical questions raised concerning: (A) whether percentage equipment depreciation charges unrealistically high; and (B) whether new bridge construction "average" costs are based on bridges of higher design standards than appropriate for Aceh. (Re) equipment depreciation, we prepared accept as item of legitimate project cost, providing depreciation rates are justified and developed specifically for individual projects during establishment firm cost estimates.

5. Issue on financing local costs addressed ref B.

Drafted by: Asia/CD: SMintz/PBloom:pmd:3/25/74
Approved by: AA/ASIA: Alfred White
Clearances: ASIA/CD: ARLove_____ ENGR/OPNS:PStearns_____
ASIA/EA/I:LRieffel_____ ASIA/CD:TLustig_____
PPC/DPR:NCohen_____ ASIA/CD:JStephenson_____

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21 p.

INTENSIVE REVIEW REQUEST

INDONESIA: ACEH ROAD BETTERMENT (DL Proposal)

Prepared by: USAID/Jakarta
February 13, 1974

Indonesia -- Aceh Road Betterment

Summary

1. Borrower: Government of Indonesia (GOI)

2. Amount of Loan: $10,300,000 (Ten Million, Three Hundred Thousand Dollars)

3. Financial Plan:

AID Loan	GOI Budget	Total
$10,300,000	$9,700,000	$20,000,000

4. Objective of Project: To assist in the opening up of this potentially surplus food area of north Sumatra by upgrading national and provincial roads and reconstructing bridges; and to assist Bina Marga, the Directorate General of Highways, in its capacity to execute road betterment projects planned for this and other provinces in Indonesia.

5. Description of Project: This project, to be carried out over a five-year period, will include the betterment of 400 kilometers of road and the replacement or repair of 1500 meters of bridges within Aceh and North Sumatra Provinces on the island of Sumatra. The portion of roads within North Sumatra province under consideration for improvement include those roads which connect Aceh to the trading center of Medan. Within this network, there are over 2000 kilometers of national and provincial highways of which 1800 kilometers are in need of upgrading. This network includes many bridges in an advanced state of deterioration and in need of replacement or major repair. The segments of this road system to be upgraded and the levels of improvement to be made will be decided upon on the basis of an optimization model which provides for the greatest economic benefit to the development of Aceh. This model has been developed and is being used in Aceh as a pilot case by four UNDP advisors currently assisting Bina Marga in its highway program. Technical advisors will also be made available to assist Bina Marga in the engineering, construction and administration of this project.

6. Purpose of Loan: To finance 50% of the estimated costs of priority road and bridge betterment in Aceh and to provide for the foreign exchange cost of services of six expatriate technical advisors.

Aceh Road Betterment (DL Proposal)

Intensive Review Request

1. BACKGROUND

In 1972 the Directorate General of Highways (Bina Marga) made a survey of all national and provincial roads in connection with the planning for the preparation of the second five-year plan (REPELITA II, April 1974 - March 1979). An undated report was issued entitled Road Construction Program. The survey classified each road on a scale of 1 to 5 (very good to very bad), however, the categories were not precisely defined and the data collection was carried out by provincial public works staff without prior training. Consequently, the assignment of a classification to a particular road segment probably varied between provinces. Nevertheless, the survey did provide a current, reasonably accurate inventory of roads from which Bina Marga could begin to formulate its highway development plans.

By the spring of 1973, the UNDP had four highway experts at work with the planning division of Bina Marga: (1) evaluating the organizational structure, (2) making recommendations for operational changes, and (3) evaluating and classifying all data previously collected. Using Aceh province as its pilot case, the Bina Marga/UNDP team has formulated a methodology from which priorities will be established for improvement of any particular road segment in Aceh as well as identifying the level of improvement most feasible for each road segment. USAID made a preliminary review of both the theoretical and practical aspects of the methodology being employed and found it to be generally sound. A detailed description of the methodology will be presented in the loan paper.

2. DESCRIPTION OF PROJECT

The project will be carried out during the five years of the GOI second five-year plan and will include the betterment of some 400 kilometers of road and the replacement or repair of bridges (estimated at 1500 meters) within Aceh and North Sumatra Provinces on the island of Sumatra. The portion of roads within North Sumatra province under consideration for improvement include those roads which connect Aceh province to the trading center of Medan. Within this network, there are in excess of 2000 kilometers of national and provincial highways of which 1800 kilometers are in need of upgrading. The network includes many bridges in an advanced state of deterioration and urgently in need of replacement or major repairs.

The project will be designed to accomplish upgrading of roads and reconstruction of bridges that will result in the greatest benefit to the province. To this end, the Bina Marga/UNDP study mentioned above will identify (i) the order of priority and (ii) the recommended levels of improvement. The total area has been divided into 18 links, 14 in Aceh and 4 in North Sumatra. Each link forms an essential connection between principal cities, economic areas and/or districts. Each link is further divided into segments where the road conditions and varying terrain dictate a different level of improvement. Each of the bridges necessarily will be studied separately and priorities established based on benefits. The project will be divided into several sub-projects.

It is proposed that the AID loan provide for half of the costs of improvements of about six of the segments (totalling about 400 km) and some 1500 meters of bridges. It is pointed out, therefore, that the improvements will be to segments of the 2000 kilometers of roads within the area and not necessarily contiguous segments or in any one geographic area of the region.

The optimum level of improvement for all roads within the area will first be determined by the traffic demand based on a 10-15 years design life and without regard to budget constraints. Should the projected budget be inadequate, a lower level of improvement will be undertaken. It is anticipated that such downgrading may result in a design life of less than ten years but not below five years. AID loan funds will not be used to participate in any improvements with a design life of less than five years.

In addition to the construction, the loan will finance the foreign exchange costs for technical advisors (a maximum of six with an average of four) over about a four year period. The advisors will assist Bina Marga in the engineering, construction and administration of the project and will coordinate their activities on general policy matters with technical advisors provided under other donor projects including the IBRD-sponsored road betterment project now in the planning stage.

3 RELATION OF PROJECT TO AID PROGRAM AND GOI PRIORITIES

The IBRD Indonesian Agricultural Sector Survey states "at present, Indonesia appears to be not one, but many more or less self-contained markets. Partly, this results from inadequate and expensive surface and ocean transport . . . Transportation bottlenecks are unquestionably a very real constraint to internal marketing, regionalization and integration of the country and economy".

The proposed project will assist in the opening of potentially productive areas. The upgraded roadways will provide improved conditions for development activities in a number of other sectors. Reduced transportation costs will improve the comparative advantage of agricultural production in remote areas that are currently operating at self-sufficiency levels. The opening of a two-way access to producers and consumers markets, and to governmental services and communication will provide the framework for economic and social integration. The project should also strengthen Bina Marga's capacity to carry out road betterment projects which are planned for other provinces during the second five-year plan.

The project focuses on needs that have been assigned a high priority in both the GOI and AID development programs. One of the principal objectives is to assist in building a foundation for social and economic development in a relatively low income rural area of Indonesia which has good potential for expansion. Food crop, livestock, fishery and industrial crop production and the associated agricultural processing activities,

all offer promising development opportunities. Aceh has as a market area an adjacent province which desires to diversify its economy to tourism and industry but which is a food deficit area that must be concerned about sources of supply. The project will also complement other rural development projects in the north Sumatra region.

The GOI's second five-year plan emphasizes rural and regional development in the outer islands as a means of geographically balancing development - giving attention to areas that have remained outside the development attainments of the first five-year plan. Given the high costs of constructing new highways, the GOI has concluded that highway betterment is a more economically feasible alternative in areas with lower traffic volume. Thus, the GOI's second five-year plan includes road betterment projects in a number of provinces.

Aceh Province was one of three provinces considered for development loan assistance for road betterment. BAPPENAS identified Aceh, South Sulawesi and South Kalimantan provinces as potential surplus food areas which eventually should help relieve the food deficits of Java. Discussions with Bina Marga indicated that it considered Aceh the first priority of the three because Aceh's need for better road facilities was the greatest. Although detailed analysis was not made of the other two provinces, an inspection in Aceh province indicated that it is potentially a highly productive agricultural area but that the main roads between market centers were virtually impassable.

4. ESTIMATED COST OF THE PROJECT

The detailed costs of each road section or bridge will be computed on the basis of quantities of materials at the time the detailed design is prepared and the total units of work are known. It is anticipated that payments to the GOI from the proposed AID loan will be against such detailed cost estimates. in the loan paper, we will [illegible] rable works completed by Bina Marga.

The "average" cost per kilometer of road betterment is approximately $33,000. Some 12% of this amount is for imported components such as cement, asphalt and equipment; equipment depreciation accounts for 30%. The new bridge construction "average" cost is $3,900 per meter of 7-meter wide roadway with two 1-meter sidewalks. Approximately 18% of this cost is attributable to imported components such as cement, asphalt, rebar and bridge steel; equipment depreciation accounts for 22%.

An average of four technical advisors are anticipated over a period of four years, totalling some 200 man-months of services. It is assumed that these services can be procured for about $4,000 per man-month plus about 25% for local support costs.

Based on these "average" costs, the total estimated cost of the Aceh Road Betterment program is as set forth in the following table.

ESTIMATED COSTS - ACEH ROAD BETTERMENT

	Equipment Depreciation	Labor & Materials	Totals
Road Betterment - 400 km @ $33,000/km	$3,960,000 (30%)	$ 9,240,000 (70%)	$13,200,000 (66%)
Bridges - approximately 1500 Lineal meters @ $3,900/m	1,281,500 (22%)	4,543,500 (78%)	5,825,000 (29%)
Technical Advisors - about 4 men for some 200 man months @ $5000		1,000,000 (100%)	1,000,000 (5%)
TOTAL	$5,241,500 (26%)	$14,783,500 (74%)	$20,025,000 (100%)

AID LOAN :	Road & Bridge Improvements - 50% costs	$ 9,512,500		10,300,000
	Technical Advisors - FX costs	800,000		(51.5%)
		$10,312,500	(rounded)	
GOI SHARE:	Road & Bridge Improvements - 50% costs	9,512,500		9,700,000
	Technical Advisors - Local Costs	200,000		(48.5%)
		$ 9,712,500	(rounded)	$20,000,000
				(100%)

The above "average" cost basis of estimating is felt to be reasonable for a project of this type; for loan authorization purpose, calculation of financing is estimated against experience cost data. Payments will be made against detailed quantity calculations at the time of design. The actual cost of completed work will not be a factor in AID's reimbursement calculation. AID would pay 50% of the total estimated costs of roads and bridges, based on detailed design, regardless of actual cost. AID would allow progress payments based on completed units of work to be defined in the CAP (e.g. work in place; completed segments of roads, bridges; etc.). The need for advances in individual subprojects will be studied further during intensive review.

It should be pointed out that the number of kilometers of roads and the number of meters of bridges to be improved are preliminary estimates and that the work actually carried out will depend upon final selection and level of improvement.

5 ECONOMIC DISCUSSION

A comprehensive economic evaluation is currently being done by Bina Marga's planning division, assisted by the UNDP highway advisory team. The study methodology utilizes an optimization model which determines optimum levels of upgrading and construction schedule priorities subject to a given level of project resources. Costs, benefits, other economic evaluation criteria and construction priorities will be presented in Bina Marga's reports which are now scheduled to be available in February, 1974.

Over much of the road network under consideration, the average speed is near 30 Kph. Transportation costs run up to US 20¢/ton/km on most Indonesian roads compared to 4-5¢/ton/km in the U.S. The identifiable benefits to be derived from the proposed road betterment program -- without substantial investment in other sectors -- are (1) savings in transport cost for traffic on the existing road, and (2) benefits to the economy resulting from increases in agricultural production and general commercial activity generated by increased market accessibility.

6. IMPLEMENTATION PLAN

The project will be implemented by the Directorate General of Highways (Bina Marga) utilizing its own capabilities, resources and procedures. In addition to financing about 50% of the estimated costs of roads and bridges based on detailed design, the proposed loan will provide initially for the services of some six expatriate technical advisors to assist Bina Marga in all phases of the work. It is planned that an average of four advisors will be required over the life of the project. As presently contemplated, the advisors will include an economist for up to 12 months after detailed plans are prepared and cost estimates computed to assist in revising and updating the economic analysis for the priority sections. Other advisors will include a highway engineer, materials engineer, bridge engineer, equipment engineer and contract administrator. An advertisement for publication in the Commerce Business Daily for indications of interest in providing such services has been sent to AID/W. Bina Marga hopes to prequalify firms and request technical proposals soonest so that the advisors can assist in the engineering and planning work.

Implementation will be carried out by the various divisions of Bina Marga through a special project unit set up specifically for this project. This unit will incorporate personnel of the Aceh Provincial Public Works organization. Details of the organization have not been finalized but it is the long-range goal of Bina Marga to develop the capabilities of the provincial public works department. It is planned that provincial

personnel will be utilized on this project to the extent that they are capable and available. Further treatment of the organization for the project as well as its implementation and monitoring will be included in the loan paper.

A special team consisting of Bina Marga personnel and UNDP highway advisors are in the final stage of work on an appraisal of Aceh roads. The field work, consisting of traffic counts, speed surveys, origin and destination survey, road conditions, geometric road properties and bridge inventories has been completed. These basic data are being interpreted for presentation in the pilot study report. User benefits and development benefits are being computed; costing data are being formulated. Employing an "optimization" matrix approach, the study will identify the most desirable level of improvement as well as alternative levels of improvement at less cost and with fewer economic benefits.

The Bina Marga Engineering Office, located at Bandung, will prepare all of the field surveys, the final specifications, the cost estimates and the contract documents. That office will also perform engineering supervision, materials testing and contract administration. It will be assisted by the technical advisors in their various fields of specialization. The engineering office presently includes approximately 108 professional people. Last year it completed the designs and specifications for 1000 kilometers of roads and 2000 meters of bridges. Its capability is being increased to 2000 kms of roads and 3000 meters

of bridges to accommodate the Aceh project and to work on an IBRD road betterment program involving some 1600 kms of highway.

We believe the Engineering Office at Bandung, with the assistance of the technical advisors, has the capability to do all project engineering to acceptable standards.

Bridges will be built entirely by contractors, most of whom operate out of Medan. A preliminary survey indicates that there are a sufficient number of qualified contractors available. Several bridge construction sites were visited and each showed good level of performance. The contractors are generally small and the work progresses slowly. They do not have modern equipment and rely heavily on hand labor and crude methods of construction. However, the finished product appears to be quite adequate. Bridge spans of less than five meters and box culverts will be constructed by force account.

There are very few road construction contractors available on Sumatra who have the capability to execute all phases of a road project. The road contractors who are available are primarily brokers who supply labor and trucks with Bina Marga personnel doing compaction and other jobs which require the use of heavy equipment. This procedure will probably be followed initially. It is anticipated, however, that contractors will develop greater capabilities and take on a progressively larger share of the work as the road betterment program proceeds. Bina Marga has expressed its desire in assisting them in this direction. The reason

that there is little contractor capability now is due to the near complete stagnation of the road improvement program up to 1969 and lack of substantial quantities of improvement work during the first five-year plan 1969-74. We believe that the GOI's vastly increased road improvement program as contained in the second five-year plan (1974-79) will sufficiently stimulate contractors to invest in equipment and expand their operations to meet the demand.

The GOI has decided that a mix of hand labor and machine methods must be employed for the Aceh road improvement program since the area is sparsely populated and labor generally scarce. Preliminary figures by Bina Marga indicate a need for a peak force of 4000 laborers at the height of construction with an average throughout the project of 2200 laborers. If the labor-intensive method were used exclusively, some 15,000 laborers would be required for four years. The logistical problems alone associated with frequently moving base camps would be monumental.

The preliminary findings of the IBRD labor-vs-machine intensive technology study indicate that certain road-building tasks performed by hand labor are feasible from the practical point of view, e.g. minor embankment cuts, light fills, small concrete pours, small drainage ditches or small bridge foundations. The study also indicates that all "heavy" tasks plus many of light tasks mentioned above, are performed more economically by machine methods.

Construction methods will depend on local conditions but will be as labor intensive as possible considering local labor availability and other economic conditions. Construction methods will be discussed in more detail in the loan paper.

ISSUES

The principal issues connected with this proposal arise because the project is responsive to AID's new directions.

As with many projects of this sort, assistance requirements are less oriented toward the traditional foreign exchange component and more in the form of needs to finance local outlays that will directly create employment and encourage the development of local expertise and business enterprise.

While it is recognized that additional authority has been given to finance local costs, in the absence of established procedures and AID experience in Indonesia, there are inevitably uncertainties about the efficacy of various alternative implementation techniques.

Issues specifically concern the following proposals:

- To consider AID financing as a local cost element except for the expatriate technical services;

- To use the "fixed cost reimbursement" procedure as the method of measuring the AID contribution;

- To link AID local cost financing to a special Letter of Credit procedure.

USAID has proposed and the GOI has agreed to consider the "fixed cost reimbursement" method whereby AID would reimburse the GOI for completed units

of work meeting agreed-upon standards of design and construction. As noted above, ultimate reimbursement would be for 50% of the estimated costs of roads and bridges (based on detailed design), including such costs as equipment, materials and services. "Progress" reimbursements are anticipated. In short, AID would reimburse the GOI for satisfactorily completed units of project work, would not reimburse for each of the required inputs (materials, equipment, engineering services, etc.) and would not require total completion of each project before making any reimbursement. The only exception would be the U.S. technical assistance for the project.

The reimbursement approach has been selected because it is well adapted to the nature of this project and because this project does not lend itself to the traditional AID financing procedures for large scale capital development projects involving predominantly foreign exchange costs and expatriate services. This project in fact consists of a number of relatively small projects whose costs are predominantly local currency and which will be constructed by predominantly local personnel. We have estimated, for example, that equipment depreciation will be the largest budget item, amounting to the equivalent of $5.2 million, some 26% of the total cost of the project (see Table p. 7). Some of this equipment is already available to Bina Marga while some new equipment may have to be imported. Thus far, however, it has not been possible for us to estimate the amount of new imports that may be required, or to allocate the utilization of either available or newly imported equipment to this project (as distinguished from other projects on which Bina Marga will use the imported equipment), nor has it been possible to determine the amount of equipment and materials that will

be procured by Bina Marga, on the one hand, or by private contractors on the other, during the life of the project.

Use of the reimbursement approach also carries with it fringe benefits arising from avoidance of the conventional procurement guidelines. For example, tied procurement for the comparatively small component of foreign exchange costs involved in this project would create delays resulting from advertising and bidding requirements, current material and transportation shortages and the multiplicity of small procurement contracts anticipated over the life of the project.

It is preferable to use only one method of financing local costs in Indonesia and, as there are insufficient untied funds for all projects, all funds should be tied under the Special Letter of Credit procedure. Through such a procedure, whatever amount AID lends for this project would produce an equivalent amount of US sales but would not impede implementation by requiring the use of tied procurement for goods and services utilized in this project.

8 STATUS OF PROJECT DEVELOPMENT AND PREPARATION

Extensive discussions have been held with planning and highway officials of both the central and provincial governments. The Bina Marga pilot study of Aceh roads is scheduled for completion in draft form in February, 1974. Reference materials regarding meetings with various GOI officials, other donor agencies, inspections and other relevant data were pouched to AID/W by airgrams A-240 dated October 5, A-248 dated October 17 and A-276 dated November 23, 1973. Two cable summaries were also transmitted: JAKARTA 10858 dated September 12 and JAKARTA 12185 dated October 13, 1973.

An advertisement for publication in the Commerce Business Daily soliciting expressions of interest from firms for the furnishing of technical advisory services was sent to AID/W by airgram A-04 dated January 11, 1974. It is hoped that prequalification and review of technical proposals can be completed prior to loan authorization.

As a further indication of the high priority which Bina Marga attaches to the Aceh program, the engineering section at Bandung has commenced field surveys of some of the known priority road sections to enable the earliest possible start of construction.

USAID has already begun preparation of the loan paper. After receipt of the Bina Marga/UNDP Aceh pilot study, the Project Committee will be in a position to complete the draft and plans to submit the draft loan paper to AID/W in April. Since April is the first month of the GOI fiscal year, the 1974-75 budget should be approved by that time.

Since the annual rainfall in Aceh province tends to be greater than in most other provinces of Indonesia, Bina Marga hopes to get a quick start on construction during this year's "dry" season, April to October. We hope to have a signed Loan Agreement by June 30 and be in a position to fund the technical services contract and begin reimbursement for upgrading work as it is completed.

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : AA/ASIA, Mr. D. G. MacDonald

DATE: March 14, 1974

FROM : ASIA/CD, Mr. Theodore H. Lustig

SUBJECT: Indonesia: IRR for Proposed $10.3 million Aceh Road Betterment Loan

The attached IRR is submitted for consideration by the Asia Advisory Committee for Capital Assistance, at a meeting which has been scheduled for ~~3:00~~ 4:00 p.m. Wednesday, March 20, 1974 in Room 6439 Newstate.

Approval of the IRR is recommended.

cc: AA/ASIA: A. D. White
ASIA/DP: A. Shakow
ASIA/EA: P. Oechsli
ASIA/EA/I: L. Smucker
ASIA/TECH: R. Ballantyne
PPC/DPR: F. Kimball
SER/COM: W. B. Schmeisser
SER/FM: S. Brown
SER/ENGR: R. Keegler
SER/ENGR: P. Stearns
PPC/DPR: B. Clary
GC/ASIA: J. Burgess
PPC/RC: E. Griffel
ASIA/CD: S. A. Taubenblatt
ASIA/CD: J. E. Stephenson
ASIA/CD: L. Rosenberg
ASIA/CD: A. R. Love
OMB: Emily Leonard

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